Claims:

What is claimed is:

1. A method for prebalancing an electrical property obtained from at least one of a first body part and a second substantially similar body part, the method comprising the steps of:

obtaining a prebalancing factor (*PBF*) from a population group to account for variability between the first body part and the second body part;

measuring an electrical property of at least one of the first body part and the second body part with an electrode array; and

utilizing the prebalancing factor to prebalance the electrical property.

2. The method of claim 1, wherein the first and second body parts are breasts.

3. The method of claim 1, wherein the electrode array includes a plurality of current injection electrodes and a plurality of voltage measurement electrodes.

4. The method of claim 3, wherein the electrical property is electrical impedance, and wherein the step of measuring includes

injecting currents into the first body part with the plurality of current injection electrodes;

measuring a set of impedances $\{Z_{i,j}^{\text{first}}\}$ with the plurality of voltage measurement electrodes;

injecting currents into the second body part with the plurality of current injection electrodes; and

measuring a set of impedances $\{Z_{i,j}^{\text{sec}}\}$ with the plurality of voltage measurement electrodes.

5. The method of claim 4, wherein the step of utilizing the prebalancing factor includes

prebalancing $\{Z_{i,j}^{\text{first}}\}$ and $\{Z_{i,j}^{\text{sec}}\}$ to yield the sets $\{Z_{i,j}^{\text{first}*}\}$ and $\{Z_{i,j}^{\text{sec}*}\}$, where

$$Z_{i,j}^{\text{first}*} = PBF \times Z_{i,j}^{\text{first}} \text{ and } Z_{i,j}^{\text{sec}*} = Z_{i,j}^{\text{sec}}, \text{ if } PBF \geq 1, \text{ and}$$

$$Z_{i,j}^{\text{first}*} = Z_{i,j}^{\text{first}} \text{ and } Z_{i,j}^{\text{sec}*} = Z_{i,j}^{\text{sec}} / PBF, \text{ if } PBF < 1.$$

6. The method of claim 5, further comprising comparing $\{Z_{i,j}^{\text{first}*}\}$ to $\{Z_{i,j}^{\text{sec}*}\}$ to diagnose the possibility of disease.

7. The method of claim 1, wherein the step of obtaining a prebalancing factor includes obtaining sets of normalizing factors $\{r_{i,j}^{\text{first}}\}$ and $\{r_{i,j}^{\text{sec}}\}$ from the population group to account for variability within the first and second body parts.

8. The method of claim 7, wherein the step of obtaining a prebalancing factor further includes

obtaining a set of impedances $\{Z_{i,j}^{\text{first}}\}$ from the first body part and a set of impedances $\{Z_{i,j}^{\text{sec}}\}$ from the second body part;

utilizing $\{Z_{i,j}^{\text{first}}\}$ and $\{r_{i,j}^{\text{first}}\}$ to calculate a set of normalized impedances $\{Znorm_{i,j}^{\text{first}}\}$, and $\{Z_{i,j}^{\text{sec}}\}$ and $\{r_{i,j}^{\text{sec}}\}$ to calculate a set of normalized impedances $\{Znorm_{i,j}^{\text{sec}}\}$; and

averaging a subset of $\{Znorm_{i,j}^{\text{first}}\}$ and a subset of $\{Znorm_{i,j}^{\text{sec}}\}$ to obtain the prebalancing factor, the subsets formed by omitting normalized impedances that could correspond to anomalous electrical pathways.

9. The method of claim 8, wherein the step of obtaining the set of normalizing factors $\{r_{i,j}^{\text{first}}\}$ includes

applying n_e voltage measurement electrodes to the first body part of a first member of the population group containing N_g members, where n_e and N_g are integers greater than one;

measuring in the first member a set of voltages $\{V_{i,j}^{\text{first 1}}\}$, where $V_{i,j}^{\text{first 1}}$ is the voltage between an i^{th} voltage measurement electrode and a j^{th} voltage measurement electrode, the i^{th} and j^{th} voltage measurement electrodes chosen from among the n_e voltage measurement electrodes; and

obtaining a reference specific impedance, $M_{\text{ref}}^{\text{first}}$, associated with a pair of reference electrodes chosen from among the n_e voltage measurement electrodes.

10. The method of claim 9, wherein the step of obtaining the set of normalizing factors $\{r_{i,j}^{\text{first}}\}$ further includes

calculating a set of impedances $\{Z_{i,j}^{\text{first 1}}\}$ obtained from $\{V_{i,j}^{\text{first 1}}\}$;

calculating a set of specific impedances $\{M_{i,j}^{\text{first 1}}\}$ where $M_{i,j}^{\text{first 1}} = V_{i,j}^{\text{first 1}} / d_{i,j}^{\text{first}}$ and $d_{i,j}^{\text{first}}$ is a distance related to the distance between the i^{th} and j^{th} voltage measurement electrodes;

calculating a set of quotients $\{q_{i,j}^{\text{first 1}}\}$ where $q_{i,j}^{\text{first 1}} = M_{i,j}^{\text{first 1}} / M_{\text{ref}}^{\text{first}}$; and

calculating quotients for other members of the population group to obtain all quotients, $\{q_{i,j}^{\text{first }K}\}$ where K runs from one to N_g.

11. The method of claim 10, wherein the step of obtaining the set of normalizing factors $\{r_{i,j}^{\text{first}}\}$ further includes calculating the set according to

$$r_{i,j}^{\text{first}} = \frac{1}{N_g} \sum_{K=1}^{Ng} q_{i,j}^{\text{first }K} .$$

12. The method of claim 8, wherein the step of obtaining the set of impedances $\{Z_{i,j}^{\text{first}}\}$ includes

applying a plurality of current injection electrodes on the first body part; and

applying a plurality of voltage measurement electrodes on the first body part.

13. The method of claim 12, wherein the step of obtaining the set of impedances $\{Z_{i,j}^{\text{first}}\}$ includes

injecting a first current between a first current injection electrode and a second current injection electrode;

measuring a resultant voltage difference between a first voltage measurement electrode and a second voltage measurement electrode;

obtaining an impedance $Z_{1,2}^{\text{first}}$ from the resultant voltage difference between the first voltage measurement electrode and the second voltage measurement electrode; and

repeating the above steps with other electrodes to obtain the set of impedances $\{Z_{i,j}^{\text{first}}\}$.

14. The method of claim 13, wherein the step of obtaining a set of normalizing factors from the population group to account for variability within

the first and second body parts includes obtaining a normalizing factor $r_{i,j}^{\text{first}}$ for each $Z_{i,j}^{\text{first}}$.

15. The method of claim 14, wherein the step of utilizing $\{Z_{i,j}^{\text{first}}\}$ and $\{r_{i,j}^{\text{first}}\}$ includes calculating a set of normalized impedances $\{Znorm_{i,j}^{\text{first}}\}$ according to

$$Znorm_{i,j}^{\text{first}} = Z_{i,j}^{\text{first}} / r_{i,j}^{\text{first}}.$$

16. The method of claim 1, further comprising utilizing the electrical property after prebalancing to diagnose the possibility of disease in one of the first body part and the second body part

17. A system for prebalancing an electrical property obtained from at least one of a first body part and a second substantially similar body, the system comprising:

a prebalancing factor module for obtaining a prebalancing factor (*PBF*) from a population group to account for variability between the first body part and the second body part;

an electrode array for measuring an electrical property of at least one of the first body part and the second body part; and

a prebalancing module for utilizing the prebalancing factor to prebalance the electrical property.

18. The system of claim 17, wherein the first and second body parts are breasts.

19. The system of claim 17, wherein the electrode array includes a plurality of current injection electrodes and a plurality of voltage measurement electrodes.

20. The system of claim 19, wherein the electrical property is electrical impedance, and wherein

the plurality of current injection electrodes are used to inject currents into the first and second body parts; and

the plurality of voltage measurement electrodes are used to measure a set of impedances $\{Z_{i,j}^{\text{first}}\}$ and $\{Z_{i,j}^{\text{sec}}\}$.

21. The system of claim 20, wherein the prebalancing factor module prebalances $\{Z_{i,j}^{\text{first}}\}$ and $\{Z_{i,j}^{\text{sec}}\}$ to yield the sets $\{Z_{i,j}^{\text{first}*}\}$ and $\{Z_{i,j}^{\text{sec}*}\}$, where

$$Z_{i,j}^{\text{first}*} = PBF \times Z_{i,j}^{\text{first}} \text{ and } Z_{i,j}^{\text{sec}*} = Z_{i,j}^{\text{sec}}, \text{ if } PBF \geq 1, \text{ and}$$

$$Z_{i,j}^{\text{first}*} = Z_{i,j}^{\text{first}} \text{ and } Z_{i,j}^{\text{sec}*} = Z_{i,j}^{\text{sec}} / PBF, \text{ if } PBF < 1.$$

22. The system of claim 21, further comprising a diagnosis module for comparing $\{Z_{i,j}^{\text{first}*}\}$ to $\{Z_{i,j}^{\text{sec}*}\}$ to diagnose the possibility of disease.

23. The system of claim 17, further comprising a normalizing factor calculation module for obtaining sets of normalizing factors $\{r_{i,j}^{\text{first}}\}$ and $\{r_{i,j}^{\text{sec}}\}$ to account for variability within the first and second body parts.

24. The system of claim 23, wherein the electrode array is used to obtain a set of impedances $\{Z_{i,j}^{\text{first}}\}$ from the first body part and a set of impedances $\{Z_{i,j}^{\text{sec}}\}$ from the second body part, which, together with the sets $\{r_{i,j}^{\text{first}}\}$ and $\{r_{i,j}^{\text{sec}}\}$, yield a set of normalized impedances $\{Znorm_{i,j}^{\text{first}}\}$ for the first body part, and a set of normalized impedances $\{Znorm_{i,j}^{\text{sec}}\}$ for the second body part, the system further comprising a prebalancing calculator module for obtaining the prebalancing factor after averaging of a subset of $\{Znorm_{i,j}^{\text{first}}\}$ and a subset of $\{Znorm_{i,j}^{\text{sec}}\}$, the subsets formed by omitting normalized impedances that could correspond to anomalous electrical pathways.

25. The system of claim 24, further comprising n_e voltage measurement electrodes applied to the first body part of a first member of the population group containing N_g members, where n_e and N_g are integers greater than one, to obtain a set of voltages $\{V_{i,j}^{\text{first 1}}\}$, where $V_{i,j}^{\text{first 1}}$ is the voltage between an i^{th} voltage measurement electrode and a j^{th} voltage

measurement electrode, the i^{th} and j^{th} voltage measurement electrodes chosen from among the n_e voltage measurement electrodes.

26. The system of claim 25, further comprising a specific impedance calculation module to calculate a set of specific impedances $\{M_{i,j}^{\text{first 1}}\}$ from $\{V_{i,j}^{\text{first 1}}\}$ and to calculate a specific reference impedance $M_{\text{ref}}^{\text{first}}$ associated with a pair of reference electrodes chosen from among the n_e voltage measurement electrodes, wherein $\{M_{i,j}^{\text{first 1}}\}$ and $M_{\text{ref}}^{\text{first}}$ are used to calculate a set of normalizing quotient $\{q_{i,j}^{\text{first 1}}\}$ according to $q_{i,j}^{\text{first 1}} = M_{i,j}^{\text{first 1}} / M_{\text{ref}}^{\text{first}}$, and wherein other normalizing quotients for other members of the population group are calculated to obtain all quotients, $\{q_{i,j}^{\text{first } K}\}$ where *K* runs from one to N_g.

27. The system of claim 26, wherein the normalizing factor calculation module calculates a set of normalizing factors $\{r_{i,j}^{\text{first}}\}$ according to

$$r_{i,j}^{\text{first}} = \frac{1}{N_g} \sum_{K=1}^{Ng} q_{i,j}^{\text{first } K} .$$

28. The system of claim 27, further comprising a diagnosis module for utilizing the electrical property after prebalancing to diagnose disease.